DOCUMENT RESUME

ED 055 118 TM 000 856

AUTHOR Frederiksen, Norman
TITLE Toward a Taxonomy of Situations.
INSTITUTION Educational Testing Service, Princeton, N.J.
PUB DATE Aug 71
NOTE 31p.; Paper presented at the 79th Annual Convention of the American Psychological Association, Washington, D. C., September 5, 1971

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Behavior; *Behavioral Science Research; *Behavior Patterns; Classification; Environmental Criteria; Individual Differences; Multiple Regression Analysis; Performance Criteria; Personality Tests; *Predictor Variables; *Research Methodology; Situational Tests; Stimulus Behavior; *Taxonomy

ABSTRACT

Criteria and methods for developing a taxonomy for different situational categories are presented. (CK)

ED055118

RM-71-11

RESEARCH MEMORANDUM

TOWARD A TAXONOMY OF SITUATIONS

Norman Frederiksen

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

TM 000 856

Paper presented at the 79th Annual Convention of the American Psychological Association, Washington, D. C., September 5, 1971.

Educational Testing Service
Princeton, New Jersey
August 1971

TOWARD A TAXONOMY OF SITUATIONS[1]

Norman Frederiksen[2]

Educational Testing Service

Several years ago a conference was held in Washington to consider the question of how to predict the behavior of a single individual. The reason the government was concerned about the question was that a single individual's behavior might be of critical importance to the United States--if he happened to be someone like Nikita Krushchev, who at that time had the power to commit his nation to economic and military acts that could affect the welfare and security of Americans.

The fact that the question was posed and that a number of well-known behavioral scientists considered the question very seriously tells us something about the state of psychology as a science. Psychologists have developed a technology of prediction that depends almost wholly on individual differences, with heavy reliance on items of biographical history and measures of ability, attitude, and personality. The method works reasonably well when the problem is to make comparative statements about probable performance of many individuals--candidates for admission to college or applicants for a job. But the personnel psychologist, at least, is likely to be stumped when asked to make predictions about how a single individual's behavior will vary from one occasion to another over a period of time. Individual differences (at least as they are usually conceived) do not provide a solution to the problem, since they do not exist for a single individual.

The personnel psychologist's solution to the prediction problem requires that we have a measure of criterion performance, y (such as a rating of job performance), and at least one measure of personal characteristic, x

(such as aptitude or interest), that is correlated with $\underline{y}$. The regression of $\underline{y}$ on $\underline{x}$ provides the basis for predicting criterion performance. If one wished to follow an analogous procedure for predicting events in the life of a single individual, we would have to consider criterion behaviors as measured on many occasions, and the predictor variables would have to be personal characteristics that vary over time. If it were possible to obtain information about Mr. Krushchev's mood just prior to the occasions when the criterion behavior was exhibited, then one might compute a regression equation for prediction of his performance on the basis of his mood.

Another possibility is to employ a completely different class of predictor variables, that of situational variables. Let us suppose, for example, that the $\underline{y}$ we wish to predict is Mr. Krushchev's willingness to compromise in international conferences. Presumably there are, somewhere in Washington, many file drawers full of records of such conferences attended by Krushchev, and suitable ratings of the criterion variable "willingness to compromise" could be made. Similarly, ratings could be made of each conference with respect to various situational variables that might be predictive of performance--for example, the extent to which the prestige of the USSR was involved. Given such data, it would be perfectly possible to obtain a regression equation which describes the relationship between $\underline{y}$ (Krushchev's willingness to compromise) and $\underline{x}$ (degree to which the prestige of the USSR is at stake). If the relationship is sufficiently high, one could "predict" the extent to which Krushchev would compromise at a new international conference, and perhaps one could have controlled to some degree Krushchev's behavior by managing the amount of stress placed on prestige.

Another approach to the problem is that of the clinician, who through careful study of the "dynamics" of an individual's behavior, achieves a degree of understanding that supposedly enables him to predict behavior even in circumstances where the performance has never been observed. Clinical psychologists are regularly called upon to make predictions of how a patient will respond to a kind of therapy, how a prisoner will adjust to parole, or how a manager will perform in a new position. Such judgments are of interest because the clinician makes predictions that take into account the kind of situation in which the subject will be placed. He says, in effect, that a patient with a given set of personal characteristics will behave in a particular manner when placed in a certain kind of situation. Thus the clinician's statements imply interactions between personal and situational variables.

From a scientific rather than a clinical point of view, psychologists are interested in generalizations that hold for a large number of people rather than for just one individual. There is the possibility that groups of people can be identified that are larger than one, but less than all mankind, whose behavior can be described in terms of particular kinds of relationships between performance and situational variables.

Interest in prediction models that involve precisely this kind of interaction between situations and personal characteristics has been increasing rapidly in recent years. Most notable are the efforts by educational psychologists to find evidence of "ATI," or aptitude-treatment interaction, and by organizational psychologists to find consistent differences in relationships between performance and predictor variables for organizations that differ with

regard to organizational climates. Neither search has been particularly successful so far. The reason may be that we have a lot to learn about the strategy and methodology required for doing such research.

One of the methodological difficulties is that we lack a satisfactory classification of situations. We need a systematic way of conceptualizing the domain of situations and situational variables before we can make rapid progress in studying the role of situations in determining behavior.

We do have useful taxonomies in the domain of individual differences. Following Thurstone, many factorial studies of cognitive abilities have resulted in a classification of abilities into such categories as induction, deduction, perceptual speed, ideational fluency, and so forth. The Kit of Reference Tests for Cognitive Factors, prepared by French, Ekstrom, and Price (1963), provides tests to measure such factors, and it has proved to be very useful. The availability of a common set of instruments has made it possible to integrate findings and draw inferences based on studies by a number of different investigators. Guilford's structure of intellect model has also been influential in helping to introduce a degree of coordination into the research of many investigators. His distinction between convergent and divergent thinking, for example, has contributed to clarifying research problems in the area of creative behavior. Similarly in the field of personality, factor studies by many investigators have helped to bring order into the field, even though we by no means have agreement on a list of personality dimensions.

Taxonomies of Situations

We do not have a comparable taxonomy of situations. The lack of a taxonomy to represent the stimulus side of the S-R formula is interesting

in view of the fact that individual differences was a relatively late arrival as a topic in psychology. The early behavioristic stimulus-response notion implied that all the variance in behavior was attributable to the various stimuli impinging on the organism; yet no systematic study of variation in stimuli was ever made, except in such limited domains as psychophysics, where the relations between sensory experiences were related to aspects of the physical stimulus. Experimental psychologists of all stripes, including experimental social psychologists, have shown great ingenuity in devising situations for use as experimental conditions in their investigations. But the guiding principle in devising these experiments has, naturally enough, usually been the hypothesis or theory being tested. Such work has not led to the construction of a taxonomy of situations. Perhaps the development and testing of theories would have progressed more rapidly if a taxonomy of situations had been available to guide the work of various investigators and to facilitate the drawing of inferences based on many studies by many independent investigators.

Sells (1963a) states the problem very well: "The most obvious need in evaluating the manifold encounter of organism and environment is a more satisfactory and systematic conceptualization of the environment. This implies a taxonomic, dimensional analysis of stimulus variables comparable to the trait systems that have been developed for individual difference variables.... While work proceeds actively to extend the exploration of individual differences...the equally important frontier of situational dimensions is virtually ignored.... Experimenters must have systematic information about relevant dimensions of the environment beyond the piece-meal, concrete, immediate variables customarily observed on the basis of experience."

Methods for Developing Taxonomies

How does one go about developing a taxonomy? The methods historically used in biology seem to have been based on careful observation and good judgment. They certainly cannot be characterized as "armchair" methods, since the field work must have been enormous. At the age of 25 Linnaeus, a student at Uppsala in Sweden, became interested in the classification of plants. He was sent to Lapland in 1732 as a collector of specimens, and in the next five months he traveled almost 5,000 miles in Lapland, Norway, and Sweden (at a total cost, we are told, of £25) observing, making notes and drawings, and collecting specimens. He developed a classification of plants based principally on characteristics of stamens and pistils. The method seems somewhat arbitrary, at least to a psychologist today. Why were stamens and pistils chosen rather than other morphological characteristics involving leaf, stem, roots, or fruit? What criteria should be employed in choosing a taxonomic system?

The aim of the plant taxonomist was then, and still is, to find a classification of plants that would accurately reflect their evolutionary development. The evaluation of taxonomies from that point of view requires information based on fossil remains, geographical distribution, immigration pathways, and chromosomal and biochemical relations as well as morphological features. The course of evolutionary development would seem to be an unlikely reason for seeking a taxonomy of situations. If we are to attempt to develop a taxonomy of situations for use in the behavioral sciences, what criteria can appropriately be used for choosing among the large number of classification systems that are possible?

A taxonomy is merely a useful way of classifying phenomena, whether they be books, plants, people, or ideas. It is a way of simplifying a complicated universe in order to make it easier to deal with, both conceptually and practically. Scientific advances are greatly facilitated by the availability of comprehensive and unambiguous classificatory systems.

Any classification system is to some degree arbitrary. One might sort the books in his library on the basis of size, so that they will fit on particular shelves; he might sort them on the basis of color in order to create esthetic effects; or he might sort them into categories of books he might want to consult for particular purposes. Taxonomies can be purely descriptive, or they can to various degrees represent a theoretical orientation. The periodic table of the elements represents not only a classification but also a useful theory about the nature of matter.

In psychology we have few well-established taxonomies except in the domain of individual differences. We do not have accepted taxonomies of situations. What are some possible criteria for choosing one taxonomic system rather than another, and what empirical procedures might be employed in constructing taxonomies?

Taxonomies of Attributes and Taxonomies of Individuals

In thinking about development of taxonomies, it is important to distinguish between taxonomies of attributes and taxonomies of individuals. The taxonomies used to describe individual differences in psychology are classifications of attributes of people, not classifications of the people themselves. The categories in the classifications are entities like ideational fluency and extroversion, not groups of people. In biological taxonomies, on the other hand, the elements are categories composed of the

organisms themselves, such as oak, maple, pine, and hemlock trees. The difference is surely not accidental. The analog of species in biology would be types in psychology, and many attempts by psychologists to develop typological classifications of people have not survived, presumably because more people fall between the idealized types than fit them. Such is not the case in dendrology: oaks, maples, and pines can all be identified, even by a novice, and no individuals are found that fall between the oak and the maple. Such a claim cannot be made for distinctions between Jung's extroverts and introverts, among Spranger's theoretic, economic, aesthetic, social, political, and religious types, or among Freud's erotic, compulsive, and narcissistic types.

Both taxonomies of attributes and taxonomies of individuals would presumably be useful, but since the criteria and the procedures for developing classificatory schemes might differ, it will be well to discuss them separately.

Development of Taxonomies of Attributes

The empirical method most commonly used by psychologists for empirically developing a taxonomy of attributes would appear to be factor analysis. The procedure involves the following steps: (1) obtaining a list of variables that encompass the domain of investigation (e.g., cognitive abilities), (2) finding or developing a satisfactory method of measuring each variable (or a sample of the variables), (3) administering the resulting battery of tests to a sample of individuals representative of those possessing the attributes, (4) computing the intercorrelations of the tests, and (5) carrying out the various steps involved in the factor analysis, including rotation of axes. All these are familiar procedures except the first: how does one obtain a list of variables comprising the domain of investigation?

In his early work on personality, Cattell (1946) solved the problem by going to the dictionary. He assumed that any important aspect of human personality would have a name; on this reasonable assumption, he identified the words in the dictionary that were descriptive of personality and used this list to represent the domain. The Thurstones apparently used a variety of methods in assembling their batteries of cognitive tests. They chose items and item types that had previously been used by psychologists in tests of intellectual abilities, but they also made use of what Guttman would now call facet analysis and were guided by a general hypothesis as to what the emerging factor structure might be. They put into the battery tests to represent such facets as verbal, numerical, and visual abilities, and they included tests that would help answer such specific questions as "whether reasoning involves a distinct mental ability which transcends the detailed form on which it is exercised" (Thurstone, 1938, page 11), such as verbal, numerical, or spatial material.

There is no prescription that can be given to the would-be developer of a taxonomy of attributes of situations with regard to how to proceed. Sampling from a population of attributes would be desirable but impractical, since we do not have the necessary roster from which to draw a sample. One should certainly try to take advantage of any existing classification that can be found, and he should make as much use as he can of facet design. In the initial stages it would be prudent, one would think, to delimit the search to subtypes of situations, such as classrooms or typing pools, rather than situations in general. Classifying trees would be a far more feasible undertaking than classifying all living organisms. Ultimately, a taxonomy of situations, if we ever have one, will surely not be the work of any one investigator.

Sells (1963b) has employed a scheme proposed by Sherif and Sherif (1956) to develop an "outline of basic aspects of the total stimulus situation" that should be consulted by anyone embarking on a project to develop a taxonomy of attributes of situations. The outline is quite extensive (it occupies nearly five pages of small type) and it includes categories and subcategories concerned with weather, social institutions, socioeconomic status, informal group structure, regulation of group procedure, etc., etc.

Krause (1970) proposes the following seven subclasses of social behavior settings: (1) Joint working (which involves a mutual goal and some promise of compensation), (2) Trading (which aims to compromise conflict of interest through exchange), (3) Fighting (any means of settling a conflict without compromise), (4) Sponsored teaching (involves modification of a learner's behavior), (5) Serving (one participant receives from another some satisfaction of a need for which the second participant receives some compensation), (6) Self-disclosure (revelation of one's opinions to another), and (7) Playing (a nonserious approximation of other situations merely for the pleasures of the performance). As Krause points out, wide ranges of variations within these categories are possible, involving physical environments, roles, institutional contexts, and other aspects of the setting as suggested by Sells' outline.

One area of empirical investigation that has produced several classifications of attributes of situations is the measurement of college environments (Pace, 1968). Pace and Stern (1958) produced an instrument for measuring college environments in 1958, and since then a number of studies have yielded results that may be thought of as contributing to a taxonomy of situations. An instrument developed by Pace called College and University Environment Scales

(CUES) is currently in use. The items are statements that might describe a particular college (e.g., "There is a lot of group spirit"). The items were administered to students, who responded by judging whether each statement is true or not true. A statement is assumed to be true about the college if two thirds or more of the students endorse it, and a score for the institution is obtained by using this standard. A factor analysis of such scores obtained from 50 colleges and universities produced five factors which are the basis for the five scales employed in the current version of CUES. College environments can thus be described in terms of measures of five attributes named Practicality, Community, Awareness, Propriety and Scholarship.

Another factor analytic study of college environments (Astin, 1962) was based on 33 items of information obtainable from public sources, such as size, proportion of men, number of fields in which degrees are offered, percent of Ph.D.'s on the faculty, and budget. Data from 300 schools were obtained. The five factors obtained were named affluence, size, masculinity, homogeneity of offerings, and technical emphasis. The number of categories obtained from these studies is quite small. Surely the diversity among American colleges cannot be adequately described by only five dimensions. A beginning has been made toward the development of a taxonomy of attributes of situations, but we have a long way to go.

Development of Taxonomies of Situations

We have shown that factor analytic procedures might be useful in developing taxonomies of situational attributes, and examples have been cited of such applications of the method. What empirical methods are available for developing taxonomies of the situations themselves?

The simplest method is merely to define situational categories in terms of combinations of attributes. Given a list of attributes, it is possible to generate a classification of the situations themselves merely by taking all the possible combinations of attributes. A description of trees in terms of three dichotomous attributes would generate two cubed or eight categories of specimens. The three dichotomies might, for example, be broad leaves vs. needle- or scale-like leaves, coniferous vs. non-coniferous, and deciduous vs. non-deciduous. One category defined by these attributes contains trees that are deciduous, coniferous, and have needle-shaped leaves, and would include the larch and the tamarack; the category formed by deciduous, non-coniferous, and broad-leaved would include the so-called hardwoods. An objection to such a procedure is that if there are a large number of attributes, the number of categories of individuals generated would become very large indeed. However, if many of these categories turn out to be empty cells, the method still might be feasible. In the tree example, the category defined by deciduous, coniferous, and broad-leaved would turn out to be an empty cell because there is no known tree possessing this combination of attributes.

Hoepfner and Klein (1970) at the Center for the Study of Evaluation at UCLA have used this method of constructing a taxonomy in developing differentiated test norms for schools. The data came from the Coleman study of equality of educational opportunity (Coleman, et al., 1966). Eight attributes of schools were employed, all of which are continuous measures; one was trichotomized and the others were dichotomized. The eight attributes are based on the following questionnaire items:

1. What is the racial balance in your school?
2. How many families of your students are represented at a typical meeting of the PTA or similar parent group?

3. How many volumes do you have in your school library?

4. About what percentage of the students who attended your school last year are now attending a different school? Do not count those who moved because of graduation or promotion.

5. Which best describes the location of your school? (Small town, city, rural, etc.)

6. Which best describes the pupils served by your school? (Parents' occupations)

7. What percentage of the students in your school have mothers who are employed outside the home?

8. Which of the following indicates the area of the country in which your school is located?

Three hundred eighty-four categories of schools are generated by this classification of attributes (3×2^7). For each category, Hoepfner and Klein report two scores. A school principal could use the school-attribute classification to find which one of the 384 school categories his school belongs in; and by comparing the mean score for his school with the scores listed for that category, he could find out whether the mean for his school is low, middle, or high in comparison with other schools like his own.

With the large number of attributes that one would ordinarily expect to be associated with situations, the method would undoubtedly generate an astronomical number of categories, and it would be useful only if some further method of data reduction could be used.

There are of course a variety of statistical methods that might be used in searching for categories of situations. One of the earliest attempts to develop a measure of similarity was that of Pearson (1926), who developed a "coefficient of racial likeness." R. A. Fisher (1936) developed discriminant

analysis for use in taxonomy, reported in an article entitled "The use of multiple measurements in taxonomic problems." This approach is mainly useful, however, if the categories are already known and one wants to minimize error in using variables in assigning individuals to those categories.

A method that is useful for exploratory studies is inverse factor analysis. In any factor study one begins with a vector of attribute scores for each of a sample of individuals. In a conventional factor analysis, correlations between all the pairs of attributes are computed and factored. In inverse factor analysis one begins with the same kind of matrix, but computes correlations between all the pairs of individuals. A high correlation means that two individuals are similar with respect to their scores on the attributes, and a factor then represents a cluster of individuals all of whom tend to be alike with regard to their attribute scores. Thus, an inverse factor analysis based on a matrix of morphological attributes for a population of trees would presumably yield factors interpretable as oaks, maples, pines, etc.

More generally, there are a variety of methods that are potentially useful in developing taxonomies, called cluster analysis (e.g., McQuitty, 1956; Rubin, 1967; Tryon & Bailey, 1966). Such methods begin with a vector of attribute scores for individuals, as in inverse factor analysis, but the measure of similarity for a pair of individuals is not usually a correlation coefficient. It might be simply the number of characteristics shared by two individuals, a pooled judgment of the similarity of two objects, the Euclidean distance between two vectors (Cronbach & Gleser, 1953; Osgood & Suci, 1952) or a generalized distance measure of a more sophisticated sort

(Mahalanobis, 1936). The cluster analysis methods have in common the identification of groups of similar individuals. The clusters themselves may be grouped hierarchically (Friedman & Rubin, 1967; Ward, 1963). Nonmetric multidimensional scaling methods (Kruskal, 1964; Shepard, 1962) may be used to search for clusters if one is unwilling to make metric assumptions about his data. The interpretation of a cluster or hierarchy of clusters (like the interpretation of a factor in conventional factor analysis) depends ultimately on a judgment regarding the characteristics common to the individuals that comprise the cluster.

The use of numerical methods in plant and animal taxonomy has been increasing in recent years (Sokal & Sneath, 1963), with applications in a wide variety of areas of biology and anthropology. An interesting application of cluster analysis was recently reported in Science (True & Matson, 1970) that comes a little closer to our problem of classifying situations. Twenty archeological sites in Chili were described in terms of 74 characteristics, mainly based on bead and stone artifacts found at the sites. Similarity coefficients were computed for the pairs of sites, and a cluster analysis was carried out. Four main clusters were found; they tended to confirm grouping of sites that had previously been made judgmentally. One cluster, for example, contained artifacts suggesting utilization of vegetable foods and a minimum concern with hunting.

A more direct attempt to develop a taxonomy of situations is Hemphill's (1959) study of characteristics of executive positions. Hemphill developed a questionnaire containing a large number of statements that might be descriptive of some aspect of an executive's position (e.g., "negotiate bank loans

for the company"). The items were obtained from literature describing executive behavior, from interviews with executives, and from job descriptions. Executives from several companies responded to each item by rating the degree to which it was a part of his position. An inverse factor analysis was performed, using the correlations between pairs of executives who responded to the questionnaire. Ten orthogonal factors were identified, and the interpretation of each factor was based on an investigation of the activities of the executives comprising that factor. The executive positions were classified as follows:

1. Providing a staff service
2. Supervision of work
3. Business control
4. Technical--markets and products
5. Human, community, and social affairs
6. Long range planning
7. Exercise of broad power and authority
8. Business reputation
9. Personal demands
10. Preservation of assets

The interpretations of the factors were written in terms descriptive of the executive positions, and thus the statements resemble attributes of jobs rather than the jobs themselves. But methodologically the study fits the cluster analysis rather than the factor analysis design. This classification would obviously be useful in studying the interactions of personal characteristics of executives with the characteristics of their positions in predicting performance.

Rock, Baird, and Linn (1971) generated classifications of colleges by using Ward's (1963) hierarchical clustering technique. Their data were based

on students attending 95 different colleges. The basis of the clustering was similarity of colleges with respect to regression parameters--intercepts, slopes, and mean predictor scores--for the regression of a GRE score on a predictor test. Separate classifications of colleges were developed based on GRE Humanities, Social Science, and Natural Science achievement test scores, using either SAT-V or SAT-M as the predictor. Rock, Baird, and Linn found five groups of colleges based on the Humanities criterion. One group of 17 colleges, for example, was characterized by steep regression lines, high intercepts, and high means for the predictor, SAT-V. Another group was characterized by flatter slopes and low predictor scores. Discriminant function analysis was employed in an effort to see if the groups could be described in terms of different college characteristics. Group 1 was found to have higher scores than the other groups on five college characteristics, including selectivity, budget, and percentage of students graduating in four years. The potential usefulness of such taxonomies in student guidance and educational research is apparent.

Saul Sells (1964) proposed a somewhat similar basis for classifying organizations. His notion was that the differential patterns of predictive weights obtained for various combinations of factors be used as the basis for the clustering of organizations, using as the criterion the behavior of the organization with regard to some task or function.

Classification of Situations Based on Elicited Behavior. The criterion for determining taxonomic categories implied by the factor and cluster analysis methods is mutual similarity of the members of the factor or cluster. Such a criterion can be defended on such grounds as objectivity and empirical feasibility. But another criterion for classification could be proposed in the

case of a taxonomy of situations. Instead of assigning situations to clusters on the basis of their mutual possession of various attributes, it is possible to group situations on the basis of their tendency to elicit similar behaviors. Such a criterion would seem to be especially appropriate when one's ultimate purpose is the investigation of person-situation interactions in predicting behavior.

The kind of data that is necessary for the empirical development of taxonomic categories by this criterion is rarely obtained. What is needed, for each of a large number of persons, is a record of which of many behaviors are displayed in response to each of many situations. In other words, a three-dimensional data matrix is required, the three dimensions representing subjects, behaviors, and situations. Given such a data matrix, our usual practice would be to collapse across situations to form a subject-by-performance matrix and to factor the matrix of intercorrelations of the behaviors. Such a procedure would yield a classification of behaviors. (We could also collapse across situations and factor the intercorrelations of subjects--an inverse factor analysis. This would yield clusters of people and possibly a basis for a typology.)

Still another possibility is to collapse the data matrix across people, yielding a situation-by-performance matrix. I am suggesting that the correlations between all the pairs of <u>situations</u> be computed and that a factor analysis of this intercorrelation matrix be performed. A high correlation between two situations means that they elicit similar behaviors; thus a factor represents a cluster of situations that tend to evoke the same responses.

Such factors would constitute the categories in a taxonomy of situations, using the criterion of similarity of behaviors elicited rather than the criterion of similarity with respect to attributes.

The steps described so far are preliminary to a three-mode factor analysis (Tucker, 1966). Once factors in the domain of performance and in the domain of situations are obtained, one can go on to the computation of factors in the domain of the subjects. Subject factors may be interpreted on the basis of the relationships between performance factors and situation factors that characterize each person factor. Thus the model provides a method for investigating person-situation interactions. The existence of person factors demonstrates an interaction between personal characteristics and situational variation.

Data that permit one to perform such an investigation are rare because we do not in one investigation ordinarily evaluate many aspects of performance in each of many situations; more typically, one or two dependent variables are recorded for one or two experimental conditions plus a control condition. Data reported in a monograph by Endler, Hunt, and Rosenstein (1962) are relevant, although the basic datum is a self-report of what the subject thought his response would be to each hypothetical situation, rather than a record of actual behavior.

The data were obtained by administering an "S-R Inventory of Anxiousness" to 169 college students. The inventory required the respondent to report the probable intensity of each of 14 possible responses in each of 11 different situations. The responses included, for example, "heart beats faster," "perspire," "enjoy the challenge," "become immobilized"; and the situations included such things as "You are going to meet a new date," "You are starting out in a sailboat into a rough sea," and "You are going into an interview for

an important job." A three-mode factor analysis of the data was done by Levin (1965) and reported by Tucker (1965) at the 1964 Invitational Conference.

The analysis revealed three factors in the domain of the responses reported. These factors are interpreted as (1) General Distress (with high loadings on "get an uneasy feeling," "heart beats faster," "emotions disrupt actions"); (2) Exhilaration (with high loadings on "enjoy the challenge," "seek experiences like this," "feel exhilarated and thrilled"); and (3) Autonomic Responses (with high loadings on "have loose bowels," "need to urinate frequently," "get full feeling in stomach").

The situation factors were also three in number and were interpreted as (1) Interpersonal Stress situations (with loadings on speech before a large group, interview for an important job, a competitive contest); (2) Dangerous Inanimate situations (on a ledge high on a mountainside, alone in the woods at night, sailboat on a rough sea); and (3) "Unknown" situations (going into a psychological experiment, starting off on a long automobile trip, going to a counseling bureau to seek help in solving a personal problem). Thus if one uses the criterion of similarity of responses elicited, the taxonomy for this very limited domain of situations would comprise the three categories of interpersonal stress situations, dangerous inanimate situations, and facing "unknown" situations.

The interpretation of the core matrix that resulted from the three-mode factor analysis showed that there are individual differences with respect to the relationship of response categories to the situational categories. Three person factors were found, each of which can be interpreted in terms of the responses characteristically made to the situation factors. The idealized

OS

person representing Person Factor I tended to report distress and autonomic responses to the interpersonal stress and dangerous inanimate situations, and he reported little exhilaration. The Person Factor II individual was likely to report exhilaration to all three types of situations, but particularly the inanimate danger situation. The Person Factor III individual reported exhilaration in the interpersonal stress situations and distress and autonomic responses to the inanimate danger situations. These are somewhat over-simplified interpretations of the person factors.

Another three-dimensional data matrix exists (Frederiksen, Jensen, & Beaton, in press) that permits one to search for situation factors, and the data represent actual behaviors rather than reports of how the subject thought he would behave. The data were obtained through the use of a realistic situational test that simulates the paper work of an executive.

Subjects were executives employed by the state of California in jobs varying from middle-management levels to department heads appointed by the governor. They were employed in a variety of fields from health and highways to accounting and law. During a two-day "research institute" each subject served as an executive in a simulated job--that of Chief of the Field Services Division of the Department of Commerce. His instructions were to deal with the items in his in-basket as though he were actually on the job. He was to take whatever action he deemed appropriate, such as writing letters or memoranda, asking for information, calling meetings, making appointments, making notes on his calendar, writing reminders to himself, or throwing things in the waste basket. The in-basket items were identical for all subjects, and all had the same opportunity to acquaint themselves with background materials describing the organization and the new job in which each subject found himself.

At the end of the exercise, each subject left behind a large envelope full of his written responses to the items. The scoring of these protocols was based on a list of about 60 categories of behavior, such as postpones decision, takes leading action, sets a deadline, gives directions to subordinates, follows lead by superior, makes plans only, courtesy to peers, and schedules work for a specific day. The score sheet provides a row for each in-basket item and a column for each category of behavior. The scorer recorded a 1 or a 0 in each cell to indicate presence or absence of the behavior defined by each behavior category. Thus a stack of score sheets literally corresponds to the three-dimensional data matrix, the three dimensions representing the situations (the in-basket items), performance (the behavior categories), and subjects.

Collapsing the matrix across items, we get the customary subject-by-behavior matrix, and a factor analysis of the intercorrelations of the behavior categories resulted in 10 performance factors. They were given names like thoughtful analysis of problems, informality, controls subordinates, interacts with superiors, defers judgment and action, and productivity.

Collapsing the matrix across subjects gives us an item-by-behavior matrix, and factoring the intercorrelations of all the pairs of items results in six item factors. An item factor is a cluster of items that are alike in that they tend to elicit the same behaviors. If we adopt as our criterion for classifying items their similarity with regard to behaviors elicited, these six factors may be thought of as constituting a taxonomy of paper-work problems, at least for the sample of items employed in the study. The factors were quite easy to interpret on the basis of inspection of the items with the highest loadings. The factors were given the following names:

1. Items requiring evaluation of procedures for accomplishing organizational goals.
2. Items permitting a routine solution.
3. Items requiring solution of interorganizational problems.
4. Items requiring solution of personnel problems.
5. Items recommending a change in policy.
6. Items presenting conflicting demands on staff time.

These factors may tentatively be regarded as constituting a taxonomy of situations in a domain of the in-basket problems of state executives.

The final step in the three-mode factor analysis revealed that person factors clearly do exist and that person-situation interactions are therefore demonstrated. There isn't time to go into detail about the person factors, but they did appear to be interpretable in terms of the appropriate slices of the core matrix. Person Factor I, for example, is characterized by tendencies to be orderly and to work through subordinates in responding to items that present problems involving personnel and relations with other organizations. This pattern recalls the stereotype of the low-level supervisor who deals with short range day-to-day operational problems. Person Factor I was named systematic supervisor.

The two examples show the feasibility of classifying situations on the basis of their similarity with regard to the behaviors they elicit. In both examples the categories comprising the taxonomy were readily interpretable, and in both instances they proved to be useful in demonstrating person-situation interactions. In addition to cluster analysis and other methods for empirically developing taxonomic categories of situations, the method based on the criterion of similarity with regard to behaviors elicited seems worthy of further exploration and use, particularly for investigations of person-situation interactions.

If one wanted to go to the trouble, he might be able to get his hands on those file drawers full of proceedings of international conferences attended by Krushchev. After careful study of the contents, one might be able to develop a method of scoring the records of Krushchev's behavior, using categories like agrees, compromises, denies, accuses, evades, attacks, yells, and pounds with shoe. Then the protocol for each conference could be scored in terms of frequency of occurrence of each behavior category. This procedure would produce a situation-by-performance matrix. It might then be possible to discover a set of conferences in which Krushchev's behavior was characterized by agreeing and compromising and another set characterized by attacking and shoe-pounding. If one could then find what were the differentiating characteristics of the two sets of conferences, he would have discovered a possible way to predict and control Mr. Krushchev's behavior--although a little too late tc be of much practical use.

A scientist seeking broader generalizations would want to extend the observations to a larger number of people, in order to see if the relationship between type of conference and behavior holds only for Krushchev, if it is true of everyone, or if it describes the behavior of a substantial subgroup of individuals. This would require the scientist to score the protocols of others who attended the same conferences, in order to generate the three-mode data matrix that would be required. Our scientist would probably give up this particular enterprise quite soon because of a host of problems involving feasibility and experimental control. But the example perhaps illustrates three points: (1) study of person-situation interactions would be facilitated by the existence of a suitable taxonomy of situations; (2) it is possible to develop such taxonomies empirically;

and (3) a possible criterion for use in empirically developing a taxonomy of situations is the similarity of situations with regard to the behaviors they elicit.

References

Astin, A. W. An empirical characterization of higher educational institutions. Journal of Educational Psychology, 1962, 53, 224-235.

Cattell, R. B. The Description and Measurement of Personality. New York: World, 1946.

Coleman, J. S., et al. Equality of Educational Opportunity. Washington, D. C.: U. S. Government Printing Office, 1966.

Cronbach, L. J., & Gleser, G. C. Assessing similarity between profiles. Psychological Bulletin, 1953, 50, 456-473.

Endler, N. S., Hunt, J. McV., & Rosenstein, A. J. An S-R inventory of anxiousness. Psychological Monographs, No. 536, 1962, 76, No. 17.

Fisher, R. A. The use of multiple measurements in taxonomic problems. Annals of Eugenics, 1936, 7, 179-188.

Frederiksen, N., Jensen, O., & Beaton, A. Prediction of Behavior: Interactions of Educational and Personal Variables. New York: Pergamon Press, in press.

French, J. W., Ekstrom, R., & Price, L. A. Manual for Kit of Reference Tests for Cognitive Factors. Princeton, N. J.: Educational Testing Service, 1963.

Friedman, H. P., & Rubin, J. On some invariant criteria for grouping data. Journal of the American Statistical Association, 1967, 62, 1159-1178.

Hemphill, J. K. Job descriptions for executives. Harvard Business Review, 1959, 37, 55-67.

Hoepfner, R., & Klein, S. P. Elementary School Evaluation Kit. Booklet IV. Collecting Information. Los Angeles: University of California, 1970.

Krause, M. S. Use of social situations for research purposes. American Psychologist, 1970, 25, 748-753.

Kruskal, J. B. Multidimensional scaling by optimizing goodness of fit to a nonmetric hypothesis. Psychometrika, 1964, 29, 1-27.

Levin, J. Three-mode factor analysis. Psychological Bulletin, 1965, 64(6), 442-452.

Mahalanobis, P. C. On the generalized distance in statistics. Proceedings of the National Institute for Science, India, 1936, 12, 48-58.

McQuitty, L. L. Agreement analysis: Classifying persons by predominant patterns of responses. British Journal of Statistical Psychology, 1956, 9, 5-16.

Osgood, C. E., & Suci, G. A measure of relation determined by both mean difference and profile information. Psychological Bulletin, 1952, 49, 251-262.

Pace, C. R. The measurement of college environments. In R. Tagiuri and G. H. Litwin (Eds.), Organizational Climate: Explorations of a Concept. Boston: Graduate School of Business Administration, Harvard University, 1968. Pp. 129-147.

Pace, C. R., & Stern, G. G. An approach to the measurement of psychological characteristics of college environments. Journal of Educational Psychology, 1958, 49, 269-277.

Pearson, K. On the coefficient of racial likeness. Biometrika, 1926, 18, 105-117.

Rock, D. A., Baird, L. L., & Linn, R. L. Interaction between college effects and students' aptitudes. Research Bulletin 71-17. Princeton, N. J.: Educational Testing Service, 1971.

Rubin, J. Optimal classification into groups: An approach for solving the taxonomy problem. Journal of Theoretical Biology, 1967, 15, 103-144.

Sells, S. B. An interactionist looks at the environment. American Psychologist, 1963, 18, 696-702. (a)

Sells, S. B. (Ed.) Stimulus Determinants of Behavior. New York: Ronald, 1963. (b)

Sells, S. B. Toward a taxonomy of organizations. In W. W. Cooper, H. J. Leavitt, & M. W. Shelly (Eds.), New Perspectives in Organizational Research. New York: Wiley, 1964.

Shepard, R. N. The analysis of proximities: Multidimensional scaling with an unknown distance function I. Psychometrika, 1962, 27, 125-140.

Sherif, M., & Sherif, C. W. An Outline of Social Psychology. (Rev. ed.) New York: Harper, 1956.

Sokal, R. R., & Sneath, P. H. A. Principles of Numerical Taxonomy. San Francisco: Freeman, 1963.

Thurstone, L. L. Primary mental abilities. Psychometric Monographs, 1938, No. 1.

True, D. L., & Matson, R. G. Cluster analysis and multidimensional scaling of archeological sites in northern Chile. Science, 1970, 169, 1201-1203.

Tryon, R. C., & Bailey, D. E. The BC TRY computer system of cluster and factor analysis. Multivariate Behavioral Research, 1966, 1, 95-111.

Tucker, L. R. Experiments in multi-mode factor analysis. In Proceedings of the 1964 Invitational Conference on Testing Problems. Princeton, N. J.: Educational Testing Service, 1965. Pp. 46-57.

Tucker, L. R. Some mathematical notes on three-mode factor analysis. Psychometrika, 1966, 31, 279-311.

Ward, J. H., Jr. Hierarchical grouping to optimize an objective function. Journal of the American Statistical Association, 1963, 58, 236-244.

Footnotes

[1]Presidential Address, Division of Evaluation and Measurement (Division 5), presented at the 79th Annual Convention of the American Psychological Association, Washington, D. C., September 5, 1971. This paper is based on portions of a book entitled Prediction of Behavior: Interactions of Situational and Personal Variables, by N. Frederiksen, A. Beaton and O. Jensen, to be published by Pergamon Press.

[2]Requests for reprints should be sent to Norman Frederiksen, Educational Testing Service, Princeton, N. J., 08540.